

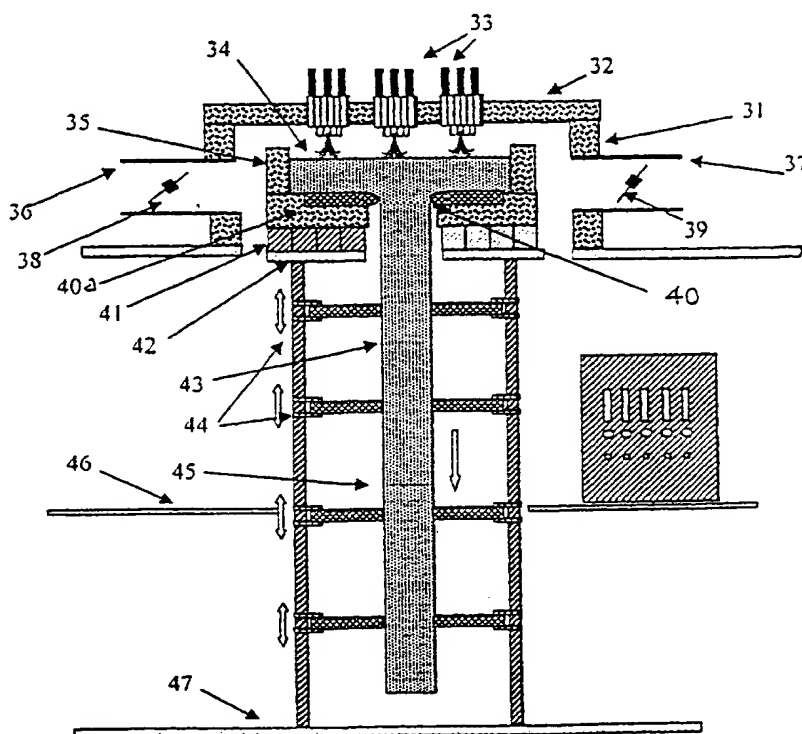
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : C03B 19/14, 17/04, 19/09		A1	(11) International Publication Number: WO 00/03955
			(43) International Publication Date: 27 January 2000 (27.01.00)
(21) International Application Number: PCT/GB99/02278 (22) International Filing Date: 15 July 1999 (15.07.99) (30) Priority Data: 9815357.0 15 July 1998 (15.07.98) GB (71) Applicant (for all designated States except US): TSL GROUP PLC [GB/GB]; P.O. Box 6, Wallsend, Tyne and Wear NE28 6DG (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): SAYCE, Ian, George [GB/GB]; 21 Crabtree Road, Stocksfield, Northumberland NE43 7NX (GB). WELLS, Peter, John [GB/GB]; 2 Linden Way, Gateshead, Tyne and Wear NE9 7BL (GB). (74) Agent: MANATON, Ross, Timothy; J.Y. & G.W. Johnson, Kingsbourne House, 229-231 High Holborn, London WC1V 7DP (GB).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report.	

(54) Title: PROCESS AND APPARATUS FOR MANUFACTURING A GLASS INGOT FROM SYNTHETIC SILICA

(57) Abstract

A method and apparatus for the manufacture of synthetic vitreous silica ingots involves the production of a melt of synthetic vitreous silica in a crucible (35) within a refractory furnace (31), and the continuous withdrawal of an ingot (43) through an orifice (40) in the wall of the crucible. The silica may be deposited in the crucible by a synthesis burner (33), which may also serve to maintain the silica above its sintering temperature. The emerging ingot is supported by an arrangement of moveable clamps (44).



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NO. 11 AMDT.

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CLAIMS

1. A method of forming a shaped body of synthetic vitreous silica glass, including the steps of generating a mass of molten vitreous silica contained in a refractory
5 container, part of the boundary of which defines a shaping orifice, and removing the generated synthetic silica from the container through the orifice as a shaped ingot.

2. A method according to claim 1, wherein the shaping orifice is located at the lowest part of the mass in the
10 refractory container and the removal involves positively withdrawing the ingot from below.

3. A method according to claim 2, wherein synthetic silica is added to the mass at a rate substantially similar to that at which the ingot is withdrawn .

15 4. A method according to claim 1, 2 or 3, wherein the synthetic silica is deposited into the refractory container from a synthesis burner, the burner also serving to heat the melt so that the silica sinters directly to glass in the mass.

20 5. A furnace for the manufacture of a synthetic vitreous silica ingot, the furnace comprising: a furnace enclosure housing a refractory container, the refractory container adapted to hold a melt of synthetic vitreous silica; one or more burners extending into the furnace enclosure and
25 adapted in operation to maintain vitreous silica within said container at or above its sintering temperature; a die disposed within a wall of said container, the die including an orifice through which the glass ingot is extruded; and an arrangement of moveable clamps downstream of the orifice,
30 adapted to support the extruded ingot.

6. A furnace according to claim 5, wherein at least one burner is a synthesis burner adapted both to deposit synthetic

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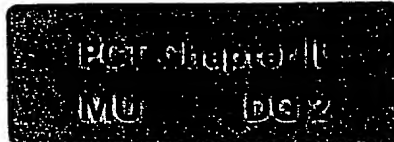
vitreous silica into the refractory container and to assist in maintaining the silica above its sintering temperature.

7. A furnace according to claim 5 or claim 6, wherein the refractory container with its die, the ingot and the arrangement of clamps can be rotated synchronously to provide a deposited glass of improved homogeneity.

8. A furnace according to any of claims 5 to 7, wherein the refractory container with its die, the ingot and the arrangement of clamps can be moved to and fro horizontally to permit spreading of the pattern of deposited glass from the one or more burners.

9. A furnace according to any of claims 5 to 7, wherein the refractory container with its die, the ingot and the arrangement of clamps can be moved in orthogonally disposed x- and y- directions, to permit spreading of the pattern of deposited glass from the one or more burners.

10. A furnace according to any of claims 5 to 7, wherein spreading of the pattern of deposited silica is achieved by horizontal movement of the burner array and/or the refractory container.



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Attention: International Examination Authority

Our Ref

RTM.hmg

Your Ref

15th August 2000

Dear Sirs

**International Patent Application PCT/GB99/02278
in the name of TSL Group plc**

This is in response to the Written Opinion dated 17th April 2000.

Filed herewith in triplicate is a new set of claims to replace all of the claims currently on file. New claim 1 is based on previous claim 5 and new claim 7 is based on previous claim 1. Support for the wording newly introduced into the independent claims may be found in original claims 3 and 6 and in the paragraph running between lines 21 and 31 on page 4 of the description.

As will be seen from the introductory portion of the specification (see for example page 4, lines 5 to 9), the aim of the invention is to provide a continuous process for the manufacture of synthetic vitreous silica glass. In particular, the invention is concerned with the production of glass having high optical quality and ultra high purity (in the sense of having an almost complete absence of unwanted impurities) such as is required for use, for example, in the optical, optical fibre, and semi-conductor industries. D2 is also concerned with the production of synthetic vitreous silica of this type, although it does not provide a continuous process.

D1 is not concerned with the production of glass of such ultra-high purity, but instead relates to glass of a significantly lesser (although still high) degree of purity, for example for use as integrated circuit sealants, fire-resistant materials, high strength glass, moulds for lost-wax processes, catalysts and cosmetics. For these applications the precise dimensions of the ingot, the homogeneity, optical quality, freedom from bubbles and inclusions etc are irrelevant, as the product rod is intended to be crushed to powder before use. In contrast, the glasses manufactured by means of the present invention are required to be of well-defined shape and dimensions, of high optical quality,

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and of a purity of at least an order of magnitude greater than those of D1. As will be shown in more detail below, D1 essentially relates to a completely different industry from that of the present invention.

In view of the Examiner's comments, the independent claims have been re-cast in order to make it clearer how the invention is distinguished from the cited art. As a result, the claims are now restricted to the provision of at least one silica synthesis burner in the furnace chamber, which serves to deposit high purity synthetic vitreous silica by vapour deposition into the refractory container. The deposition arrangement may be similar to that depicted in D2, but the apparatus and method are clearly quite different from that of D2 in that they provide for the continuous production of ingot drawn from a die in the container wall or base.

Although D2 enables a highly pure disc-shaped ingot to be manufactured, the method suffers from the disadvantage that, if one wishes to produce an ingot having (say) a square cross section, it is necessary to cut or otherwise to machine the required shape from the disc-shaped ingot. This is a costly and wasteful process and at best yields only short lengths of the appropriately shaped product. Likewise, to produce rods of circular cross-section, these need to be cored (or "trepanned") from the mother ingot, again with significant wastage. The only alternative to cutting or machining is to re-heat the ingot in a mould. Above all, the D2 apparatus must necessarily be operated as a batch method, it being quite impossible to produce an ingot or rod of indeterminate length e.g. a long ingot of high aspect ratio.

D2 probably quite accurately reflects the closest state of the art at the priority date of the application; indeed, it is upon a process of this type that the inventors set out to improve. The Examiner nevertheless chooses to regard another document (D1) as representing the closest prior art. It is understandable why he has done so, since the figures accompanying the document seem to illustrate apparatus which is superficially similar to that of the application, but the Examiner (and the search Examiner before him) have apparently been hampered by the fact that they have only had access to the abstract of the document. In order to access its contents fully, the applicants have obtained an English translation of the full specification, and we enclose a copy herewith for the Examiner's information.

D1 relates to a process for manufacturing a silica rod which is then crushed to a powder for use in various different applications. Silica is melted in a refractory container and the rod withdrawn through a die. In the apparatus used by the

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authors of D1 it is apparent that there is a problem of possible adhesion of refractory brick to the outer surface of the rod, as well as the possible inclusion of unmelted silica in the fused rod. These problems are addressed by carefully controlling the rate at which the rod is withdrawn, so as to keep its surface temperature constant. Whether or not the measures proposed are sufficient to solve these problems is immaterial since it is apparent from the nature of the problems themselves that D1 relates to the very different technical field from that of the present invention. D1 relates to the production of silica powder free from contamination by die-brick refractory materials and from unmelted (crystalline) materials. These are extremely basic requirements and are as nothing compared to the highly stringent requirements for manufacturing substantial ingots of high quality glass for optical, optical fibre, semi-conductor or photomask applications, for which it is well known that a supreme optical quality is essential. Any conceivable possibility of inclusion of unfused silica or particles of refractory material is completely unacceptable. Even though it is acknowledged that D1 sets out to avoid these problems, the mere possibility that such contamination might occur, even at a much reduced level, indicates quite clearly to the skilled man that the apparatus and method of D1 are totally unsuited for use in the manufacture of ultra high purity glass according to the intention. In reality D1 relates to a completely different field.

D1 is silent as to what type of silica is supplied to the furnace and as to how it is supplied. Guidance, however, can be found in other Japanese patent documents in the name of the same proprietor (NKK Corp.), which appear to be in the same "series" of patents as D1. Three of the other patents in the series were mentioned in the international search report (JP-64-3027, JP-64-3028 and JP-1-9823) and a further such patent is JP-63-288906. All of these documents are dated between November 1988 and January 1989, and there is also an earlier document (JP-61-178415) dating from August 1986. English translations of the 1988/1989 documents are enclosed herewith together with an abstract of the 1986 document. Clearly, as these all emanate from the same company and all relate to the same general subject matter, if the skilled man became aware of any of them, he would automatically be led to the others. It is therefore reasonable to read them together.

JP-63-288906 relates to a process of melting quartz sand or quartzite in a furnace built from Zirconia bricks. The melt is withdrawn in the form of a rod through a hole in the base of the furnace, and as the surface tends to be contaminated with zirconia from the furnace walls, the rod is cooled by water sprays which causes the surface layer to crack and fall off.

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There is no indication that an ultra high purity bubble-free transparent product is produced (as is produced in the present invention) and it seems likely that the rod is destined, after surface cleaning, to be pulverised to fine powder as in D1.

Similarly to D1, JP-64-3027 is concerned with controlling the melt level in a furnace used for producing a fused silica rod intended to be crushed to powder. This patent addresses essentially the same problems as those which are addressed by D1, namely the problems which stem from withdrawing the rod either too fast or too slowly and the consequent need to manage the melt level carefully. While D1 proposes to monitor the temperature of the emerging rod, JP-64-3027 opts to monitor the melt level with a microwave device or TV camera. This patent and D1 were filed within three days of each other and name the same two inventors. It seems likely, therefore, that the proprietors regarded the different methods as alternatives for use in the same type of process. Significantly, JP-64-3027 goes into a little more detail than D1 as to the source of silica in the furnace, making it clear that this is supplied as "silica stone" or "silica sand" (see page 3, line 5 of the English translation). The skilled man would realise that flame fusion of silica stone and sand would generate a melt so full of microbubbles that the resultant product would appear opaque. While this would have no particular disadvantage for a rod destined to be pulverised, it is immediately apparent that the method is totally unsuited for manufacturing glass of high optical quality.

JP-64-3028 is also specifically concerned with the heating of quartz grain to produce a fused silica rod for subsequent pulverisation, the patent being specifically directed to the pre-heating of the grain by furnace exhaust gases as a means of improving thermal efficiency. Similarly, JP-64-9823 proposes to pre-heat the combustion gases fed to the burner used for melting the silica particles.

Thus, this whole family of patents, including D1, all relate to a process for melting silica sand or quartzite to give a rod of fused silica in which contamination of the outer surface is minimised or from which the contaminated outer layers are eliminated and the inner material converted to crushed silicic acid powder. The patents are concerned with the removal of refractory particles and the avoidance of unfused silica, but there is no mention of the uniformity or bubble content of the resultant rod and certainly no suggestion that the process is suitable for manufacturing substantial glass ingots of high purity, regular shape and low bubble content as required by the present invention. There is also no indication that any acceptable visual quality can be achieved. Finally, there is no

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suggestion in any of the patents of the possibility of using any feedstock other than silica stone or sand, and no hint whatever of the possibility of replacing such feedstocks with high purity silica provided by vapour deposition. Indeed, the process of the invention is so very different in its applications and purity requirements that it would be surprising if the man skilled at manufacturing high quality optical glass would have considered any of the D1 family of patents as a suitable starting point for the large scale manufacture of optical quality ingots of well-defined shape, given that the patents relate to processes for manufacturing silica rods which may need to be decontaminated before being crushed to powder.

Even if the skilled man were to ignore or overlook the underlying differences in objective between the D1 family of patents and the present invention, and to seek a way of improving the purity of the silica rods produced by the D1-type process, it seems likely that he would seek to achieve this by employing a higher purity feedstock such as synthetic silica powder. However, the D1 patents would give the skilled man no guidance as to the chemical or visual quality of the product he might thus obtain, and there is no guidance as to how he might find an economically viable source of powder of appropriate purity to feed the furnace. The present invention seeks to avoid the need to manufacture an expensive synthetic silica powder and to avoid the difficulty of maintaining such a powder in an uncontaminated state. This is achieved by employing a very different type of burner from that appearing in the D1 patents, namely a synthesis burner fed with a volatile silica precursor which is converted to silica microparticles in the flame. This provides major technical and economical advantages compared to employment of a synthetic silica powder. In short, the D1 patents provide no teaching of the use of a synthetic powder; even less do they provide any hint of the direct deposition of synthetic silica from a synthesis burner.

The Examiner goes on to suggest, in the alternative, that it would be obvious to modify the D2 apparatus in order to achieve the furnace of the invention. In particular, he suggests that the skilled man would be led inevitably to replace the rotating shaft of the D2 apparatus with a hollow tube through which a rod of glass might be drawn. This seems an extraordinary contention, given that there is no suggestion whatever in D2 of such a possible modification, and indeed D2 expressly relates solely to batch processes and not to processes for continuous production. As noted above, the D2 process can only produce disc-shaped ingots, which then need to be machined to their required size and shape. There is no evidence whatever that the authors of D2 envisaged any process in which a rod or ingot could be

15th August 2000

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in the name of TSL Group plc**

continuously drawn from the furnace and no reason to suppose that the un inventive skilled man would be led to consider such a gross departure from the express teaching of the patent. Indeed, the present applicants are not aware that the proprietors of D2 (Corning Inc) or indeed any other company have ever attempted a process as currently claimed.

Finally, I should point out for completeness that there is no sensible way in which the teachings of D1 and D2 can be combined, either to arrive at the present invention, or at all. The two sources relate to totally different areas of the glass making industry, D2 to the production of ultra high purity optical grade glass and D1 to the production of silica powder for use in a range of applications for which purity demands are not so stringent. The man skilled in the art would simply not seek to combine these disclosures and even if he did there is no reason to suppose that he would be led to either the apparatus or the method currently claimed. I therefore request that the objections under Art 33(3) PCT be withdrawn and a favourable international preliminary examination report issued in respect of all of the present claims.

The applicants do not intend to address the matters raised by the Examiner under "item VII" during the international phase. In respect of "item VIII" I point out that the source of silica to the furnace is now expressly set out in both independent claims, thus circumventing the objection under Art 6 PCT.

Yours faithfully,



ROSS T. MANATON

PCT

**NOTIFICATION OF THE RECORDING
OF A CHANGE**

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

MANATON, Ross, Timothy
J.Y & G.W. Johnson
Kingsbourne House
229-231 High Holborn
London WC1V 7DP
ROYAUME-UNI

Date of mailing (day/month/year) 25 September 2000 (25.09.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference RTM	
International application No. PCT/GB99/02278	International filing date (day/month/year) 15 July 1999 (15.07.99)

1. The following indications appeared on record concerning:
☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address TSL GROUP PLC P.O. Box 6 Wallsend Tyne and Wear NE28 6DG United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:
☐ the person ☒ the name ☐ the address ☐ the nationality ☐ the residence

Name and Address SAINT-GOBAIN QUARTZ PLC P.O. Box 6 Wallsend Tyne and Wear NE28 6DG United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:
☒ the receiving Office ☐ the designated Offices concerned
☐ the International Searching Authority ☒ the elected Offices concerned
☒ the International Preliminary Examining Authority ☐ other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Jean-Marie McAdams Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C.20231
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 20 March 2000 (20.03.00)	
International application No. PCT/GB99/02278	Applicant's or agent's file reference RTM
International filing date (day/month/year) 15 July 1999 (15.07.99)	Priority date (day/month/year) 15 July 1998 (15.07.98)
Applicant SAYCE, Ian, George et al	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

11 February 2000 (11.02.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
 34, chemin des Colombettes
 1211 Geneva 20, Switzerland

Authorized officer

Pascal Piriou


REC'D 04 OCT 2000

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference RTM		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) FOR FURTHER ACTION	
International application No. PCT/GB99/02278	International filing date (day/month/year) 15/07/1999	Priority date (day/month/year) 15/07/1998	
International Patent Classification (IPC) or national classification and IPC C03B19/14			
Applicant [TSL GROUP PLC et al.] <i>Saint-gobain quartz PLC.</i>			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none">I <input checked="" type="checkbox"/> Basis of the reportII <input type="checkbox"/> PriorityIII <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicabilityIV <input type="checkbox"/> Lack of unity of inventionV <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statementVI <input type="checkbox"/> Certain documents citedVII <input checked="" type="checkbox"/> Certain defects in the international applicationVIII <input type="checkbox"/> Certain observations on the international application			
Date of submission of the demand 11/02/2000		Date of completion of this report 02.10.2000	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer De Ruiter, F Telephone No. +49 89 2399 2921	



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB99/02278

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-12 as originally filed

Claims, No.:

1-9 as received on 18/08/2000 with letter of 15/08/2000

Drawings, sheets:

1/4-4/4 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/02278

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-9
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 1.1 The furnace of claim 1 differs from the furnace explicitly disclosed in JP-A-63-319220 (NKK CORP.)(D1) and its translation (D1') by the features defined in the characterizing portion of claim 1, by which features a synthetic vitreous silica glass ingot can be manufactured continuously. However, as also the ingot or silica rod manufactured by the furnace disclosed in D1' is manufactured continuously (see page 2, line 3 of D1') and hereby the drawing rate and the melt surface height are kept constant (see page 4, lines 1 to 3 of D1') it is implicitly known from D1 that the arrangement is such as to permit continuous withdrawal of silica as ingot at a rate substantially similar to that at which silica is deposited on the melt.
- 1.2 Therefore the furnace of claim 1 only differs from the furnace disclosed in D1 in that silica soot is deposited onto the melt instead of natural silica and in that this silica soot is formed in situ by means of at least one synthesis burner.
- 1.3 However, starting from D1 it will be obvious to a person skilled in the art who wants to provide a very high purity vitreous silica glass ingot to use silica soot as raw material provided to the furnace or, as suggested by WO-A1-97/10183 (D2; see page 1, line 27 to 30 and figure 1) to form this silica soot in situ by providing at least one synthesis burner in the furnace, this as it is well known in the art that highest grade vitreous silica products are made by vapour deposition.
- 1.4 The furnace disclosed in D1 is also suitable for the manufacture of synthetic vitreous silica glass, the furnace of claim 1 having, except from the feature indicated in paragraph 1.2 above, the same features as the one disclosed in D1.
- 1.5 Therefore it appears to be obvious to a person skilled in the art, starting from the disclosure of D1, to arrive at the furnace of claim 1, so that this furnace does not appear to involve an inventive step and claim 1 does not appear to meet the requirements of Article 33(3) PCT.
2. Also in applying the teaching of D1 to a state of the art furnace as depicted in

figure 2 of the application (shown e.g. in figure 1 of WO-A1-97/10183 (D2)) a person skilled in the art would arrive at the furnace of claim 1, simply by using instead of the rod supporting the container depicted in this figure 2 a tube of which the bore extends into the container, thus providing a die through which the glass ingot can be extruded, and by providing moveable support means downstream of the die, the obvious advantage of such furnace being the fact that a rod of highly pure vitreous silica glass, having the outer dimension of the bore, can be formed continuously as in D1.

3. In claim 2 the moveable support means are more closely defined as comprising an arrangement of moveable clamps. As this feature is known from D1 (see page 4, lines 10 to 12 of D1' and figure 1) claim 2, in combination with claim 1, also does not appear to meet the requirements of Article 33(3) PCT.
4. The features defined in claims 3 to 5 are either known from D2 (claims 7 to 9) or suggested by the combination of D1 and D2, and the features defined in claim 6 just represent an inversion of movement in relation to the disclosure of D2.

Therefore these claims also do not appear to meet the requirements of Article 33(3) PCT.

- 5.1 The method of claim 7 differs from the method explicitly disclosed in D1 in that the shaped body is formed of **synthetic** vitreous silica glass, and by the features defined in the characterizing portion of this claim.
- 5.2 However, for the reasons given in paragraph 1.1 above, it is also disclosed in D1 that the silica raw material is deposited at the same rate at which silica is withdrawn as ingot through the shaping orifice.
- 5.3 Therefore the method of claim 7 only differs from the method disclosed in D1 in that synthetic silica glass soot is deposited onto the melt, which synthetic silica glass soot is formed in situ by at least one synthesis burner.
- 5.4 This is however already suggested by D2 (see paragraph 1.3 above), and it is well known in the art that thereby silica glass of the highest purity can be obtained. The

skilled person who wants to manufacture a very high purity silica glass rod will therefore certainly provide at least one synthesis burner in the furnace known from D1 and thus arrive at the method of claim 7. Consequently, the method of claim 7 does not appear to involve an inventive step so that this claim also does not appear to meet the requirements of Article 33(3) PCT.

- 6 The features defined in claims 8 and 9 are either disclosed in D1 or D2. Therefore also claims 8 and 9 do not appear to meet the requirements of Article 33(3) PCT.

Re Item VII

Certain defects in the international application

1. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
2. Documents reflecting the prior art described in relation to figures 1 and 2 are not identified in the description (Rule 5.1(a)(ii) PCT).
3. The moveable support means indicated in claim 1 are a generalisation of the arrangement of moveable clamps defined in claim 1 as originally filed, providing protection for moveable support means other than the arrangement of moveable clamps, not disclosed in the application as originally filed. Therefore the requirements of Article 34(2)(b) PCT are not met.

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

RECEIVED
- 4 OCT 2000

PCT

To:

MANATON, R
MANATON, Ross, Timothy
J.Y & G.W. Johnson
Kingsbourne House
229-231 High Holborn
London WC1V 7DP
GRANDE BRETAGNE

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year) 02.10.2000

Applicant's or agent's file reference
RTM

IMPORTANT NOTIFICATION

International application No.
PCT/GB99/02278

International filing date (day/month/year)
15/07/1999

Priority date (day/month/year)
15/07/1998

Applicant
TSL GROUP PLC et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

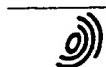
4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer

Luck, A

Tel. +49 89 2399-2665



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference RTM	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB99/02278	International filing date (day/month/year) 15/07/1999	Priority date (day/month/year) 15/07/1998
International Patent Classification (IPC) or national classification and IPC C03B19/14		
Applicant TSL GROUP PLC et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 6 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 11/02/2000	Date of completion of this report 02.10.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer De Ruiter, F Telephone No. +49 89 2399 2921 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB99/02278

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-12 as originally filed

Claims, No.:

1-9 as received on 18/08/2000 with letter of 15/08/2000

Drawings, sheets:

1/4-4/4 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB99/02278

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-9
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 1.1 The furnace of claim 1 differs from the furnace explicitly disclosed in JP-A-63-319220 (NKK CORP.)(D1) and its translation (D1') by the features defined in the characterizing portion of claim 1, by which features a synthetic vitreous silica glass ingot can be manufactured continuously. However, as also the ingot or silica rod manufactured by the furnace disclosed in D1' is manufactured continuously (see page 2, line 3 of D1') and hereby the drawing rate and the melt surface height are kept constant (see page 4, lines 1 to 3 of D1') it is implicitly known from D1 that the arrangement is such as to permit continuous withdrawal of silica as ingot at a rate substantially similar to that at which silica is deposited on the melt.
- 1.2 Therefore the furnace of claim 1 only differs from the furnace disclosed in D1 in that silica soot is deposited onto the melt instead of natural silica and in that this silica soot is formed in situ by means of at least one synthesis burner.
- 1.3 However, starting from D1 it will be obvious to a person skilled in the art who wants to provide a very high purity vitreous silica glass ingot to use silica soot as raw material provided to the furnace or, as suggested by WO-A1-97/10183 (D2; see page 1, line 27 to 30 and figure 1) to form this silica soot in situ by providing at least one synthesis burner in the furnace, this as it is well known in the art that highest grade vitreous silica products are made by vapour deposition.
- 1.4 The furnace disclosed in D1 is also suitable for the manufacture of synthetic vitreous silica glass, the furnace of claim 1 having, except from the feature indicated in paragraph 1.2 above, the same features as the one disclosed in D1.
- 1.5 Therefore it appears to be obvious to a person skilled in the art, starting from the disclosure of D1, to arrive at the furnace of claim 1, so that this furnace does not appear to involve an inventive step and claim 1 does not appear to meet the requirements of Article 33(3) PCT.
2. Also in applying the teaching of D1 to a state of the art furnace as depicted in

figure 2 of the application (shown e.g. in figure 1 of WO-A1-97/10183 (D2)) a person skilled in the art would arrive at the furnace of claim 1, simply by using instead of the rod supporting the container depicted in this figure 2 a tube of which the bore extends into the container, thus providing a die through which the glass ingot can be extruded, and by providing moveable support means downstream of the die, the obvious advantage of such furnace being the fact that a rod of highly pure vitreous silica glass, having the outer dimension of the bore, can be formed continuously as in D1.

3. In claim 2 the moveable support means are more closely defined as comprising an arrangement of moveable clamps. As this feature is known from D1 (see page 4, lines 10 to 12 of D1' and figure 1) claim 2, in combination with claim 1, also does not appear to meet the requirements of Article 33(3) PCT.

4. The features defined in claims 3 to 5 are either known from D2 (claims 7 to 9) or suggested by the combination of D1 and D2, and the features defined in claim 6 just represent an inversion of movement in relation to the disclosure of D2.

Therefore these claims also do not appear to meet the requirements of Article 33(3) PCT.

5.1 The method of claim 7 differs from the method explicitly disclosed in D1 in that the shaped body is formed of **synthetic** vitreous silica glass, and by the features defined in the characterizing portion of this claim.

5.2 However, for the reasons given in paragraph 1.1 above, it is also disclosed in D1 that the silica raw material is deposited at the same rate at which silica is withdrawn as ingot through the shaping orifice.

5.3 Therefore the method of claim 7 only differs from the method disclosed in D1 in that synthetic silica glass soot is deposited onto the melt, which synthetic silica glass soot is formed in situ by at least one synthesis burner.

5.4 This is however already suggested by D2 (see paragraph 1.3 above), and it is well known in the art that thereby silica glass of the highest purity can be obtained. The

skilled person who wants to manufacture a very high purity silica glass rod will therefore certainly provide at least one synthesis burner in the furnace known from D1 and thus arrive at the method of claim 7. Consequently, the method of claim 7 does not appear to involve an inventive step so that this claim also does not appear to meet the requirements of Article 33(3) PCT.

- 6 The features defined in claims 8 and 9 are either disclosed in D1 or D2. Therefore also claims 8 and 9 do not appear to meet the requirements of Article 33(3) PCT.

Re Item VII

Certain defects in the international application

1. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
2. Documents reflecting the prior art described in relation to figures 1 and 2 are not identified in the description (Rule 5.1(a)(ii) PCT).
3. The moveable support means indicated in claim 1 are a generalisation of the arrangement of moveable clamps defined in claim 1 as originally filed, providing protection for moveable support means other than the arrangement of moveable clamps, not disclosed in the application as originally filed. Therefore the requirements of Article 34(2)(b) PCT are not met.

- 13 -

CLAIMS

1. A furnace for the manufacture of synthetic vitreous silica ingot, the furnace comprising: a furnace enclosure housing a refractory container, the container being adapted to hold a melt of synthetic vitreous silica; 5 a die disposed within a wall or base of the container, the die including an orifice through which the glass ingot is extruded; moveable support means downstream of the orifice, adapted to support and facilitate withdrawal of the ingot; and one or more burners adapted to maintain the silica above 10 its sintering temperature; characterised in that at least one burner is a synthesis burner, such burner(s) being provided with associated means for the supply of silica precursor and combustion gases and being adapted to deposit synthetic vitreous silica by vapour deposition on to the 15 surface of the melt, the arrangement being such as to permit continuous withdrawal of silica as ingot at a rate substantially similar to that at which silica is deposited by the synthesis burner(s).

2. A furnace according to claim 1, wherein the 20 moveable support means comprises an arrangement of moveable clamps.

3. A furnace according to claim 2, wherein the refractory container with its die, the ingot and the arrangement of clamps can be rotated synchronously to provide 25 a deposited glass of improved homogeneity.

4. A furnace according to claim 2 or claim 3, wherein the refractory container with its die, the ingot and the arrangement of clamps can be moved to and fro horizontally to permit spreading of the pattern of deposited 30 glass from the burner(s).

AMENDED SHEET

- 14 -

5. A furnace according to claim 2 or claim 3 wherein the refractory container with its die, the ingot and the arrangement of clamps can be moved in orthogonally disposed x- and y- directions, to permit spreading of the pattern of deposited glass from the one or more burners.

6. A furnace according to claim 2 or claim 3, wherein spreading of the pattern of deposited silica is achieved by movement of the burner or burner array and/or of the refractory container.

7. A method of forming a shaped body of synthetic vitreous silica including the steps of: generating a melt of synthetic vitreous silica contained in a refractory container, part of the boundary of which defines a shaping orifice; maintaining the melt in a molten state by heating with one or more burners; and removing the generated synthetic vitreous silica through the orifice as a shaped ingot; characterised in that at least one burner is a synthesis burner, and the silica is deposited from such synthesis burner(s) in such a manner that synthetic vitreous silica can be deposited at a rate substantially similar to that at which silica is withdrawn as ingot through the shaping orifice.

8. A method according to claim 7, wherein the shaping orifice is located at the lowest part of the mass in the refractory container and the removal involves positively withdrawing the ingot from below.

9. A method according to claim 7 or claim 8, wherein the synthesis burner(s) serves to heat the surface of the melt so that the deposited silica sinters directly to glass.

AMENDED SHEET

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

MANATON, R
MANATON, Ross, Timothy
J.Y. & G.W. Johnson
Kingsbourne House
229-231 High Holborn
London WC1V 7DP
GRANDE BRETAGNE

RECEIVED

19 APR 2000

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of mailing (day/month/year) 17.04.2000	
Applicant's or agent's file reference RTM	REPLY DUE within 3 month(s) from the above date of mailing
International application No. PCT/GB99/02278	International filing date (day/month/year) 15/07/1999
Priority date (day/month/year) 15/07/1998	
International Patent Classification (IPC) or both national classification and IPC C03B19/14	
Applicant TSL GROUP PLC et al.	

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:

I	<input checked="" type="checkbox"/>	Basis of the opinion
II	<input type="checkbox"/>	Priority
III	<input type="checkbox"/>	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	<input type="checkbox"/>	Lack of unity of invention
V	<input checked="" type="checkbox"/>	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	<input type="checkbox"/>	Certain document cited
VII	<input checked="" type="checkbox"/>	Certain defects in the international application
VIII	<input checked="" type="checkbox"/>	Certain observations on the international application
3. The applicant is hereby **invited to reply** to this opinion.


When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: **15/11/2000**.

Name and mailing address of the international preliminary examining authority:

 European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer / Examiner

De Ruiter, F

Formalities officer (incl. extension of time limits)
Ghellere, M
Telephone No. +49 89 2399 2053



I. Basis of the opinion

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"*):

Description, pages:

1-12 as originally filed

Claims, No.:

1-10 as originally filed

Drawings, sheets:

1/4-4/4 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims
Inventive step (IS)	Claims 1-10
Industrial applicability (IA)	Claims

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The method of claim 1 only differs from the method explicitly disclosed in PATENT ABSTRACTS OF JAPAN vol. 13, no. 169, 21 April 1989 (1989-04-21) & JP 63 319220 A (NKK CORP.), 27 December 1988 (1988-12-27) (D1) in that the vitreous silica glass is a **synthetic** vitreous silica glass and in that the container is a **refractory** container. However, as the word refractory has the meanings "difficult of fusion" and "fire resistant" it apparently has to be interpreted as only meaning that it is resistant to the temperatures needed for fusion of the silica material, which characteristic the container shown in D1 also must have, so that the second difference indicated above is in fact implicitly disclosed in D1.

It also appears to be obvious to a person skilled in the art that in the method shown in D1 silica material has to be added to the furnace in some way, as otherwise no such a long rod (5) could be formed in this process, and that, if a very high purity silica rod, the silica added to the furnace should be synthetic silica.

Therefore it appears to be obvious to a person skilled in the art, starting from the disclosure of D1, to arrive at the method of claim 1, so that this method does not appear to involve an inventive step and claim 1 does not appear to meet the requirements of Article 33(3) PCT.

2. Also in applying the teaching of D1 to a state of the art method as depicted in figure 2 of the application (shown e.g. in figure 1 of WO-A1-97/10183 (D2)) a person skilled in the art would arrive at the method of claim 1, simply by using instead of the rod supporting the container depicted in this figure 2 a tube of which the bore extends into the container, the obvious advantage of such method being the fact that a rod, having the outer dimension of the bore, can be formed continuously as in D1.
3. The features defined in claims 2 to 4 are either disclosed in D1 or D2, or trivial (claim 3). Therefore also claims 2 to 4 do not appear to meet the requirements of

Article 33(3) PCT.

4. The furnace of claim 5 differs from the furnace depicted in figure 1 of D2 in that a die is disposed within a wall of the container, the die including an orifice through which the silica glass is extruded as a shaped ingot, in that an arrangement of moveable clamps is provided downstream of the orifice adapted to support the extruded ingot and in that the burners are adapted to maintain the vitreous silica within the container at or above the sintering temperature.

In applying the teaching of D1 to this known furnace, this in order to get a furnace which makes the **continuous** production of synthetic vitreous silica rods possible, the skilled person would arrive at a furnace from which the furnace according to claim 5 only differs by the provision of a die comprising the opening. However, the use of such a die appears to be obvious to a person skilled in the art as, by exchanging such a die for another die with a differently shaped opening, rods or ingots of different shapes can be formed. Hereby it should be noted that the use of such different dies for getting differently shaped extrusion products is well known in the art of extrusion forming (see also the PCT International Preliminary Examination Guidelines, C IV, 8.6).

Consequently, also the furnace of claim 5 does not appear to involve an inventive step, so that also this claim does not appear to meet the requirements of Article 33(3) PCT.

5. The features defined in claims 6 to 9 are either known from D2 (claims 7 to 9) or suggested by the combination of D1 and D2, and the features defined in claim 10 just represent an inversion of movement in relation to the disclosure of D2. Therefore these claims also do not appear to meet the requirements of Article 33(3) PCT.

Re Item VII

Certain defects in the international application

1. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

2. Documents reflecting the prior art described in relation to figures 1 and 2 are not identified in the description (Rule 5.1(a)(ii) PCT).

Re Item VIII

Certain observations on the international application

1. As no means are provided for adding synthetic silica to the container the furnace according to claim 5 is not suitable for continuous production of a synthetic vitreous silica ingot, so that the object of the invention is not achieved by this furnace, contrary to the requirements of Article 6 PCT (see the PCT International Preliminary Examination Guidelines, C III, 4.3 and 4.4).



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**Europäisches
Patentamt**

Generaldirektion 2

**European
Patent Office**

Directorate General 2

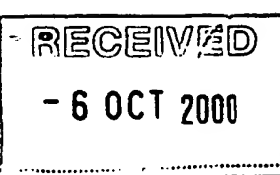
**Office européen
des brevets**

Direction Générale 2

Correspondence with the EPO on PCT Chapter II demands

In order to ensure that your PCT Chapter II demand is dealt with as promptly as possible you are requested to use the enclosed self-adhesive labels with any correspondence relating to the demand sent to the Munich Office.

One of these labels should be affixed to a prominent place in the upper part of the letter or form etc. which you are filing.



PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

MANATON, Ross, Timothy
J.Y & G.W. Johnson
Kingsbourne House
229-231 High Holborn
London WC1V 7DP
ROYAUME-UNI

Date of mailing (day/month/year) 25 September 2000 (25.09.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference RTM	
International application No. PCT/GB99/02278	International filing date (day/month/year) 15 July 1999 (15.07.99)

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address TSL GROUP PLC P.O. Box 6 Wallsend Tyne and Wear NE28 6DG United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☒ the name ☐ the address ☐ the nationality ☐ the residence

Name and Address SAINT-GOBAIN QUARTZ PLC P.O. Box 6 Wallsend Tyne and Wear NE28 6DG United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Jean-Marie McAdams Telephone No.: (41-22) 338.83.38
---	--

The demand must be filed directly with the competent International Preliminary Examining Authority, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ _____

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION	
Applicant's or agent's file reference RTM	
International application No. PCT/GB99/02278	International filing date (day/month/year) 15th July 1999 (15.07.99)
(Earliest) Priority date (day/month/year) 15th July 1998 (15.7.98)	
Title of invention PROCESS AND APPARATUS FOR MANUFACTURING A GLASS INGOT FROM SYNTHETIC SILICA	
Box No. II APPLICANT(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) TSL GROUP PLC P.O. Box 6, WALLSEND, TYNE AND WEAR NE28 6DG, UNITED KINGDOM	
Telephone No.:	
Facsimile No.:	
Teleprinter No.:	
State (that is, country) of nationality: UNITED KINGDOM	State (that is, country) of residence: UNITED KINGDOM
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) SAYCE, Ian George 21 CRABTREE ROAD, STOCKSFIELD, NORTHUMBERLAND NE43 7NX, UNITED KINGDOM	
State (that is, country) of nationality: UNITED KINGDOM	State (that is, country) of residence: UNITED KINGDOM
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) WELLS, Peter John 2 LINDEN WAY, GATESHEAD, TYNE AND WEAR, NE9 7BL, UNITED KINGDOM	
State (that is, country) of nationality: UNITED KINGDOM	State (that is, country) of residence: UNITED KINGDOM
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.	

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative

and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.

☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: (Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)

MANATON, Ross Timothy
J.Y. & G.W. Johnson
Kingsbourne House,
229-231 High Holborn,
London WC1V 7DP,
United Kingdom

Telephone No.:

+44
0207 405 0356

Facsimile No.:

+44
0207 831 9628

Teleprinter No.:

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION
Statement concerning amendments:*

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filed

the description ☐ as originally filed

☐ as amended under Article 34

the claims ☐ as originally filed

☐ as amended under Article 19 (together with any accompanying statement)

☐ as amended under Article 34

the drawings ☐ as originally filed

☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). (This check-box may be marked only where the time limit under Article 19 has not yet expired.)

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.

☐ which is the language of a translation furnished for the purposes of international search.

☐ which is the language of publication of the international application.

☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby elects all eligible States (that is, all States which have been designated and which are bound by Chapter II of the PCT)

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary Examining Authority use only

received not received

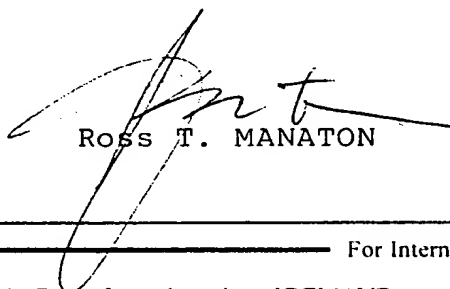
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (<i>specify</i>): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).


ROSS T. MANATON

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5. below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.


For International Bureau use only

Demand received from IPEA on:

PCT 10. 08. 1999

REQUEST

(88)

Th
acc SA 242524


For receiving Office use only

PCT/GB99/02278

International Application No.

15-07-99

International Filing Date 15 JULY 1999

United Kingdom Patent Office
PCT International Application

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum) RTM

Box No. I TITLE OF INVENTION

MANUFACTURE OF SYNTHETIC VITREOUS SILICA INGOT

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

TSL Group PLC
P.O. Box 6,
Wallsend,
Tyne and Wear,
NE28 6DG,
United Kingdom

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:

United Kingdom

State (that is, country) of residence:

United Kingdom

This person is applicant
for the purposes of:☐ all designated
States☒ all designated States except
the United States of America☐ the United States
of America only☐ the States indicated in
the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SAYCE, Ian George
21 Crabtree Road,
Stocksfield,
Northumberland NE43 7NX,
United Kingdom

This person is:

☐ applicant only☒ applicant and inventor☐ inventor only (If this check-box
is marked, do not fill in below.)

State (that is, country) of nationality:

United Kingdom

State (that is, country) of residence:

United Kingdom

This person is applicant
for the purposes of:☐ all designated
States☐ all designated States except
the United States of America☒ the United States
of America only☐ the States indicated in
the Supplemental Box☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf
of the applicant(s) before the competent International Authorities as:☒ agent☐ common representativeName and address: (Family name followed by given name; for a legal entity, full official
designation. The address must include postal code and name of country.)

MANATON, Ross Timothy
J.Y. & G.W. Johnson,
Kingsbourne House,
229-231 High Holborn,
London WC1V 7DP,
United Kingdom

Telephone No.

0171 405 0356

Facsimile No.

0171 831 9628

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the
space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

WELLS, Peter John
2 Linden Way,
Gateshead,
Tyne and Wear,
NE9 7BL,
United Kingdom

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
United Kingdom

State (that is, country) of residence:
United Kingdom

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a). (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☒ AP **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)


National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|--|--|
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BG Bulgaria | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> BR Brazil | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> NO Norway |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> CZ Czech Republic | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DE Germany | <input checked="" type="checkbox"/> RU Russian Federation |
| <input checked="" type="checkbox"/> DK Denmark | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> EE Estonia | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> FI Finland | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SK Slovakia |
| <input checked="" type="checkbox"/> GD Grenada | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IN India | <input type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> IS Iceland | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | |
| <input checked="" type="checkbox"/> KR Republic of Korea | |
| <input checked="" type="checkbox"/> KZ Kazakhstan | |
| <input checked="" type="checkbox"/> LC Saint Lucia | |
| <input checked="" type="checkbox"/> LK Sri Lanka | |
| <input checked="" type="checkbox"/> LR Liberia | |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☒ AE United Arab Emirates
- ☒ ZA South Africa
- ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 15 July 1998 (15.07.98.)	9815357.0	GB		
item (2)				
item (3)				
<input checked="" type="checkbox"/> The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): One				
<small>* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.</small>				
Box No. VII INTERNATIONAL SEARCHING AUTHORITY				
Choice of International Searching Authority (ISA) <small>(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):</small>		Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):		
ISA /		Date (day/month/year)	Number	Country (or regional Office)
Box No. VIII CHECK LIST; LANGUAGE OF FILING				
This international application contains the following number of sheets: request : 4 ✓ description (excluding sequence listing part) : 12 ✓ claims : 2 ✓ abstract : 1 ✓ drawings : 4 ✓ sequence listing part of description : Total number of sheets : 23 ✓		This international application is accompanied by the item(s) marked below: 1. <input type="checkbox"/> fee calculation sheet 2. <input type="checkbox"/> separate signed power of attorney 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: 4. <input type="checkbox"/> statement explaining lack of signature 5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 6. <input type="checkbox"/> translation of international application into (language): 7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form 9. <input type="checkbox"/> other (specify):		
Figure of the drawings which should accompany the abstract: 3		Language of filing of the international application: English		
Box No. IX SIGNATURE OF APPLICANT OR AGENT				
<small>Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).</small>				
 ROSS T. MANATON				

For receiving Office use only	
1. Date of actual receipt of the purported international application: 15 JULY 1999/15-07-99	2. Drawings: <input checked="" type="checkbox"/> received: <input type="checkbox"/> not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA /	6. <input checked="" type="checkbox"/> Transmittal of search copy delayed until search fee is paid.

For International Bureau use only
Date of receipt of the record copy by the International Bureau:

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference RTM	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 99/ 02278	International filing date (day/month/year) 15/07/1999	(Earliest) Priority Date (day/month/year) 15/07/1998
Applicant TSL GROUP PLC et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.
☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

PROCESS AND APPARATUS FOR MANUFACTURING A GLASS INGOT FROM SYNTHETIC SILICA

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

3

☐ None of the figures.

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C03B19/14 C03B17/04 C03B19/09

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 171, 24 April 1989 (1989-04-24) & JP 64 003028 A (NKK CORP.), 6 January 1989 (1989-01-06) abstract	1-3,5
X	<div style="text-align: center;">---</div> PATENT ABSTRACTS OF JAPAN vol. 13, no. 182, 27 April 1989 (1989-04-27) & JP 01 009823 A (NKK CORP.), 13 January 1989 (1989-01-13) abstract <div style="text-align: center;">---</div> <div style="text-align: center;">-/--</div>	1-3,5

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

14 October 1999

Date of mailing of the international search report

21/10/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Stroud, J

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 171, 24 April 1989 (1989-04-24) & JP 64 003027 A (NKK CORP.), 6 January 1989 (1989-01-06) abstract ---	1-3,5
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 169, 21 April 1989 (1989-04-21) & JP 63 319220 A (NKK CORP.), 27 December 1988 (1988-12-27) abstract ---	1-3,5
A	WO 97 10182 A (CORNING INC.) 20 March 1997 (1997-03-20) figure 4 ---	1,5
A	WO 97 10183 A (CORNING INC.) 20 March 1997 (1997-03-20) figures 4,5 ---	1,5
A	FR 1 363 233 A (CORNING GLASS WORKS) 23 September 1964 (1964-09-23) figure 1 -----	1,5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/02278

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
JP 64003028	A	06-01-1989	NONE		
JP 01009823	A	13-01-1989	NONE		
JP 64003027	A	06-01-1989	NONE		
JP 63319220	A	27-12-1988	NONE		
WO 9710182	A	20-03-1997	EP	0850199 A	01-07-1998
WO 9710183	A	20-03-1997	EP	0850201 A	01-07-1998
			US	5698484 A	16-12-1997
FR 1363233	A	23-09-1964	NONE		

CLAIMS

1. A furnace for the manufacture of synthetic vitreous silica ingot, the furnace comprising: a furnace enclosure housing a refractory container, the container being adapted to hold a melt of synthetic vitreous silica; 5 a die disposed within a wall or base of the container, the die including an orifice through which the glass ingot is extruded; moveable support means downstream of the orifice, adapted to support and facilitate withdrawal of the ingot; and one or more burners adapted to maintain the silica above 10 its sintering temperature; characterised in that at least one burner is a synthesis burner, such burner(s) being provided with associated means for the supply of silica precursor and combustion gases and being adapted to deposit synthetic vitreous silica by vapour deposition on to the 15 surface of the melt, the arrangement being such as to permit continuous withdrawal of silica as ingot at a rate substantially similar to that at which silica is deposited by the synthesis burner(s).

2. A furnace according to claim 1, wherein the 20 moveable support means comprises an arrangement of moveable clamps.

3. A furnace according to claim 2, wherein the refractory container with its die, the ingot and the arrangement of clamps can be rotated synchronously to provide 25 a deposited glass of improved homogeneity.

4. A furnace according to claim 2 or claim 3, wherein the refractory container with its die, the ingot and the arrangement of clamps can be moved to and fro horizontally to permit spreading of the pattern of deposited 30 glass from the burner(s).

5. A furnace according to claim 2 or claim 3 wherein the refractory container with its die, the ingot and the arrangement of clamps can be moved in orthogonally disposed x- and y- directions, to permit spreading of the pattern of deposited glass from the one or more burners.

6. A furnace according to claim 2 or claim 3, wherein spreading of the pattern of deposited silica is achieved by movement of the burner or burner array and/or of the refractory container.

7. A method of forming a shaped body of synthetic vitreous silica including the steps of: generating a melt of synthetic vitreous silica contained in a refractory container, part of the boundary of which defines a shaping orifice; maintaining the melt in a molten state by heating with one or more burners; and removing the generated synthetic vitreous silica through the orifice as a shaped ingot; characterised in that at least one burner is a synthesis burner, and the silica is deposited from such synthesis burner(s) in such a manner that synthetic vitreous silica can be deposited at a rate substantially similar to that at which silica is withdrawn as ingot through the shaping orifice.

8. A method according to claim 7, wherein the shaping orifice is located at the lowest part of the mass in the refractory container and the removal involves positively withdrawing the ingot from below.

9. A method according to claim 7 or claim 8, wherein the synthesis burner(s) serves to heat the surface of the melt so that the deposited silica sinters directly to glass.